English Translation of Document A

March 10, 2000

AOYAMA & PARTNERS

Re: Request for Japanese Patent Application Procedure

Dear Sirs,

We would like you to make patent specifications and claims based on the 12 documents attached hereto.

Sincerely yours,

SHARP KABUSHIKI KAISHA
Haruyasu SASAKI
Group General Manager
Intellectual Property Group

(seal)

Ex. 2

Confidential

SHARP

Request for Patent/Utility Model Application 0543

Reception No. 00J00996
Request No. 99L 139
Code of Patent Development Division: 51

Division making a request: Liquid Crystal Institute, Second Development Division
(Extension No. 8-742-4120)
(Code of the division: 44320)

Creation date: February 7, 2000

Space for an inventor(s)	With regard to this matter, I will assign the right to obtain a patent/utility model/design to SHARP KABUSHIKI KAISHA CO., LTD.	
	(Name code) Inventor	1. (108428) Yoshihiro IZUMI (Seal) 2. (119909) Yoshimasa CHIKAMA (Seal)
	Title of the invention	ACTIE MATRIX SUBSTRATE AND DISPLAY DEVICE, IMAGE SENSING APPARATUS
	Summary of the invention	In an active matrix substrate with a SHA structure, a negative-type photosensitive transparent conductive film is used as a material of pixel electrodes. Shortening the process is enabled. Moreover, performing exposure from the back side of the substrate enables self-aligned pattern formation of a pixel electrode.

(Continued)

Space for an immediate manager	- Technical evaluation - a. Functional effect ☑Great ☐Moderate ☐Small b. Type of invention ☐Basic invention ☑Improved/peripheral technology ☐Protection (Related patent application: None) c. Difference from well-known technology ☐Greatly different ☑Different to some extent/unclear ☐Not so much different Well-known document name (Japanese Patent No. 2933876) Prior search for well-known technology (JP10-20321 (A)) (Means of search): STAGE Search formula/classification: Keyword search	- Economical evaluation - a. Cost down ☐ Contributes greatly ☑ Contributes moderately ☐ No contribution ☐ Impossible to evaluate b. Differentiation from other companies (Sales point etc.) ☑ Greatly differentiated ☐ Differentiated ☐ Differentiated to some extent c. Market scale ☑ Large ☐ Medium ☐ Small (Specific reason: Applicable to all including LCD and FPS.) d. Lifetime of the technology/product ☐ 3 years or more ☑ unclear ☐ less than 3 years I. Possibility of reduction to practice ☐ Decision of adoption ☑ Under use and study ☐ Adoption has not been determined yet. ☐ Only conception

<table>
<tr><td></td><td></td><td>Plan for commercialization
Not determined yet.
II. Importance of the theme
☐ Primarily important
☑ Important
☐ Normal
(Merchandise strategy etc.)
Theme: Breakaway from vacuum film formation (zero-pro z015)</td></tr>
<tr><td>Requested division's opinion</td><td>Schedule for foreign patent application
☐ Scheduled
☑ Not determined yet
☐ Not scheduled

We request that this application and another application (Aoyama reference No. 170516), i.e., request No. 99L 138 (reception No. 0543) be filed on the same day.</td><td></td></tr>
<tr><td>Space for the intellectual department</td><td colspan="2">The evaluation result of the present case is as follows on the basis of the evaluation system of the invention.
☐ A. Intensively disposed
☑ B. Normally disposed
☐ C. Simply disposed (Filing/laid-open publication)
☐ D. Returning (Improper description, if no supplement is made within 3 weeks, filing is to be cancelled.)
☐ E. Cancellation of filing</td></tr>
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Title of the invention: ACTIVE MATRIX SUBSTRATE AND DISPLAY DEVICE, IMAGE SENSING DEVICE

What is claimed is:

1. An active matrix substrate comprising:

switching elements disposed in a shape of a matrix;

gate signal lines controlling the switching elements;

source signal lines supplying data signals to the switching elements and formed orthogonal to the gate signal lines;

an interlayer insulating film formed on the switching elements, the gate signal lines, and the source signal lines; and

pixel electrodes formed on the interlayer insulating film and connected to the switching elements through contact holes piercing through the interlayer insulating film, wherein

the pixel electrodes are made from a photosensitive transparent conductive material.

2. The active matrix substrate as defined in Claim 1, wherein the photosensitive transparent conductive material has negative type photosensitivity.

3. The active matrix substrate as defined in Claim 1, wherein the photosensitive transparent conductive

material is made from photosensitive resin containing transparent conductive ultrafine particles.

4. The active matrix substrate as defined in Claim 3, wherein the transparent conductive ultrafine particles are either ITO (indium tin oxide) or ATO (antimony tin oxide).

5. A flat panel display device having the active matrix substrate as defined in any one of Claims 1 to 4.

6. A flat panel image sensing device having the active matrix substrate as defined in any one of Claims 1 to 4.

Technical field to which the invention pertains:

The present invention relates to an active matrix substrate used for flat panel display devices, image sensing devices and the like.

A liquid crystal display device holds liquid crystal molecules in between two substrates on which electrodes are formed, and electric signals applied to between the electrodes on the both substrates vary the transmissivity of light coming from back light, by which information is displayed. Compared to cathode-ray tube display devices, the liquid crystal display devices are thin, light-weighted, and low power consumption, and mounted on such devices as desktop personal information terminal equipment and amusement instruments.

As demands for high fineness and high image quality of the liquid crystal display devices are increasing, a prevailing liquid crystal display device is the one of an active matrix type having active elements such as thin-film transistors (hereinafter referred to as TFT). In the field of the active matrix-type liquid crystal display device, much development efforts for increasing the aperture ratio of a pixel is made. By increasing the aperture ratio, the transmissivity of incident light from back light can be improved so that the following advantages are obtained. Lower power consumption is achieved while maintaining the illuminance of back light. With the same back light, brighter display is obtained..

Under such circumstances, there has been proposed and put into practical use, for example in Japanese Patent No. 2933876 and the like, an active matrix type liquid crystal display device in which a pixel electrode is extended all over an aperture portion in order to increase the aperture ratio of a pixel.

Fig. 5 is a plan view showing one pixel on an active matrix substrate to be used for a conventional active matrix liquid crystal display device. Fig. 6 is a cross sectional view taken on the line B-B' of Fig. 5.

In Fig. 5 and Fig. 6, reference numeral 31 denotes a light permeable substrate, reference numeral 22 denotes a gate signal line, reference numeral 23 denotes a source signal line, reference numeral 27 denotes a capacity line and reference numeral 21 denotes a pixel electrode. The fabrication process of the active matrix substrate of the conventional active matrix liquid crystal display device will hereinafter be described with reference to Fig. 5 and Fig. 6.

First, a gate signal line 22 and a capacity line 27 are formed on a light permeable substrate 31, and a gate insulating film 33 is formed so as at least to cover those lines 22 and 27. After that, at the place for forming a TFT, there are created a semiconductor layer 34, a channel protection layer 35 as needed, a source electrode 36a, and a drain electrode 36b. Then, there are formed a source signal line 23 to be connected to the source electrode 36a, and a connection electrode 25 to be connected to the drain electrode 36b, and thereafter an interlayer insulating film 38 is formed over the entire surface of the substrate. Further, in order to establish contact between a pixel electrode 21 formed on the interlayer insulating film 38 and the connection electrode 25, a contact hole 26 is provided in the interlayer insulating film 38. Thus, the pixel electrode 21 is formed.

It is noted that part of the connection electrode 25 and the source signal line 23 are formed by laminating a transparent conductive line 37a and a metal line 37b.

The pixel electrode 21 is conventionally formed by the following steps. First, the interlayer insulating film 38 and the contact hole 26 are formed, after which a transparent conductive film such as ITO (indium tin oxide) films is formed by a sputter technique and the like. On the transparent conductive film, positive type resist is applied by spin coating method. Next, while alignment with the gate signal line 22 and the source signal line 23 is performed, an exposure mask is set, and exposure is made from the upper side. Then, the transparent conductive film is etched in accordance with the exposed pattern to complete the pixel electrode 21.

On the other hand, Patent Laid-Open Publication HEI 10-20321 discloses a method of forming the pixel electrode 21 of the active matrix substrate with the above structure, using ITO materials that can form film by the coating method. Thereby, planarization at the position of the contact hole 26 is enabled. However, although there is a difference that an ITO film to serve as the pixel electrode 21 is formed by the coating method, this method is the same as the above stated fabrication method in the

point that a patterning process of the ITO film uses a photo lithography technique and an etching technique.

It will be understood that the above-stated active matrix substrate having pixel electrodes formed on an interlayer insulating film is used not only in flat panel display devices such as liquid crystal display devices but also in flat panel image sensing devices as disclosed for example in "A New Digital Detector for Projection Radiography", Proc. SPIE, Vol. 2432, pp. 237-249, 1995 by Denny L. Lee, et al.

Problem to be solved by the invention:

However, the conventional active matrix substrate described hereinabove has following problems.

① Creation of the pixel electrode 21 requires a series of steps after an ITO film is fabricated by the above-stated method over the entire surface of a substrate, the steps including application of photo resist, mask exposure and development of the photo resist, etching of the ITO film, and removal of the photo resist, resulting in long fabrication process of the pixel electrode 21.

② In the process of patterning an ITO film, when photo resist applied on the ITO film is mask-exposed, dispersion of exposure precision (pattern accuracy of photo resist) within the substrate causes corresponding dispersion of parasitic capacitance generated in a

superposed portion of the pixel electrode 21 and the source signal line 23. The dispersion of the parasitic capacitance affects the uniformity of display in display devices. In particular, upon exposure of photo resist especially by a stepper exposing device, the parasitic capacitance shows slight variance per shot of the stepper, resulting in facilitated generation of irregular display per shot.

③ In the process of patterning an ITO film, when positive type photo resist applied on the ITO film is mask-exposed, foreign matters such as dust attached on the substrate or on the mask hinder the photo resist of the attached area from being exposed, as a consequence of which the attached area is left as an unnecessary resist pattern. If the unnecessary resist pattern is present in a clearance portion between adjacent pixel electrodes, the ITO film of the portion is not etched and remains in an etching step thereafter, which causes leakage failures.

In view of the above problem, it is an object of the present invention to provide an active matrix substrate which enables to shorten the fabrication process of the pixel electrode, improve exposure precision by self alignment, and prevent leakage failures between the pixel electrodes.

Means of solving the problem:

An active matrix substrate as defined in Claim 1 of the present invention comprises:

switching elements disposed in a shape of a matrix;

gate signal lines controlling the switching elements;

source signal lines supplying data signals to the switching elements and formed orthogonal to the gate signal lines;

an interlayer insulating film formed on the switching elements, the gate signal lines, and the source signal lines; and

pixel electrodes formed on the interlayer insulating film and connected to the switching elements through contact holes piercing through the interlayer insulating film, wherein

the pixel electrodes are made from a photosensitive transparent conductive material.

In the active matrix substrate as defined in Claim 2, the photosensitive transparent conductive material has negative type photosensitivity.

In the active matrix substrate as defined in Claim 3, the photosensitive transparent conductive material is made from photosensitive resin containing transparent conductive ultrafine particles.

In the active matrix substrate as defined in Claim 4, the transparent conductive ultrafine particles are either ITO (indium tin oxide) or ATO (antimony tin oxide).

A flat panel display device as defined in Claim 5 has the active matrix substrate as defined in any one of Claims 1 to 4.

A flat panel image sensing device as defined in Claim 6 has the active matrix substrate as defined in any one of Claims 1 to 4.

Effects of the above construction will hereinafter be described.

In the active matrix substrate of the present invention, the pixel electrodes are made from a photosensitive transparent conductive material, so that in the process of patterning the pixel electrodes, the step of etching using photo resist is not required. That is to say, the pixel electrodes can be fabricated by a simple process consisting of applying a transparent conductive material with photosensitivity on the substrate, and performing photo exposure and development. Therefore, the fabrication process of the pixel electrode can be shortened. In addition, vacuum film-forming devices such as sputters as well as etching units for ITO are not required, which enables reduction of equipment investments, decrease of device space required, and increase of working

efficiency. Further the active matrix substrate of the present invention has a structure in which the pixel electrodes are formed on the interlayer insulating film, which is formed on the gate signal lines, the source signal lines, and the switching elements, so that the pixel electrodes are to be formed in the final fabrication process of the active matrix substrate. Consequently, the material of the pixel electrode does not affect the film-formation process of other parts, which brings about broader selections of materials for the pixel electrode. For example, coat-type transparent conductive materials containing an organic component (resin component) and the like can be broadly used.

In the active matrix substrate of the present invention, the photosensitive coating material has negative type photosensitivity. Therefore, using the gate signal lines and the source signal lines formed on the active matrix substrate as exposure masks and performing exposure from the back side of the substrate enable self-aligned pattern formation of film without practicing alignment. As a result, dispersion of parasitic capacitance, which is generated in a superposed portion of the pixel electrode and the gate signal line or in a superposed portion of the pixel electrode and the source signal line, can be uniformed in the entire pixel area, by which the uniformity

of display is improved. In addition, a photosensitive transparent conductive material applied over each signal line is not exposed unless any defect such as open holes are present on the signal lines. Accordingly, unlike the case of mask exposure of conventional positive type photo resist, a conductive film remain is not generated in clearance between pixel electrodes by the presence of dust in the process of exposure. This ensures insulation between the pixel electrodes.

In the active matrix substrate of the present invention, the photosensitive transparent conductive material is made from photosensitive resin containing transparent conductive ultrafine particles. Therefore, photosensitivity is easily imparted to the ITO material. It is also advantageous that the photosensitive resin determining patterning conditions such as pre-bake temperature and light exposure and the transparent conductive ultrafine particles determining conductivity can be separately optimized.

In the active matrix substrate of the present invention, since the transparent conductive ultrafine particles are made from ITO (indium tin oxide) or ATO (antimony tin oxide), it becomes possible to obtain transparency and electric characteristics required for the pixel electrode.

Mode for carrying out the invention:

A first embodiment of the present invention will be described hereinafter with reference to Fig.1 and Fig. 2.

Fig. 1 is a plan view showing an active matrix substrate of the present embodiment, and Fig. 2 is a cross sectional view taken on the line A-A' of Fig. 1. In Fig. 1 and Fig. 2, reference numeral 31 denotes a light permeable substrate, reference numeral 22 denotes a gate signal line, reference numeral 23 denotes a source signal line, reference numeral 27 denotes a capacity line, and reference numeral 21 denotes a pixel electrode. Reference numeral 33 denotes a gate insulating film, reference numeral 34 denotes a semiconductor layer, reference numeral 35 denotes a channel protection layer, reference numeral 36a denotes a source electrode, reference numeral 36b denotes a drain electrode, reference numeral 37b denotes a metal line, reference numeral 37a denotes a transparent conductive line, reference numeral 25 denotes a connection electrode, reference numeral 38 denotes an interlayer insulating film, and reference numeral 26 denotes a contact hole. (Component members having the same function are denoted by the same numerals as those of Fig.5 and Fig. 6 in the prior art.)

The semiconductor layer 34 is usually made from amorphous Si (silicon). The source electrode 36a and the drain electrode 36b are usually made from n^+ type amorphous Si. The source signal line 23 and the connection electrode 25 are formed by laminating a transparent conductive line 37a and a metal line 37b. The interlayer insulating film 38 is made from an inorganic insulator such as SiO_2 and SiNx or an organic insulator such as acrylic resin and polyimide resin.

In the present embodiment, the pixel electrode 21 is a coat-type photosensitive transparent conductive material. Thus, as shown in Fig. 2, a concave is not generated in the portion of the contact hole 26, so that the pixel electrode 21 has an approximately flat surface.

Next, a process for fabricating an active matrix substrate in the present embodiment will be described.

First, a gate signal line 22 and a capacity line 27 are formed on a light permeable substrate 31, and a gate insulating film 38 is formed so as at least to cover the lines 22 and 27. After that, at the place for forming a TFT 24, there are formed a semiconductor layer 34, a channel protection layer 35 as needed, a source electrode 36a, and a drain electrode 36b. Then, there are formed a source signal line 23 to be connected to the source electrode 36a, and a connection electrode 25 to be

connected to the drain electrode 36b, and thereafter an interlayer insulating film 38 is formed over the entire surface of the substrate. Further, in order to establish contact between a pixel electrode 21 formed on the interlayer insulating film 38 and the connection electrode 25, a contact hole 26 is provided in the interlayer insulating film 38. The fabrication process up to this point is identical to that of the prior art.

Next, as a transparent conductive film serving as a pixel electrode 21, a coat-type photosensitive transparent conductive material (e.g. a material made from transparent photosensitive resin and ultrafine particles of ITO or ATO dispersed in the transparent photosensitive resin as disclosed in Japanese Patent Laid-Open Publication HEI 10-255556) is applied uniformly over the entire surface of the substrate by spin coating method, and dried at the temperature of 80°C to 100°C for 5 to 15 minutes.

Next, the photosensitive transparent conductive film is mask-exposed, and developed to obtain a desired shape by using TMAH (tetra methyl ammonium hydroxide) based organic alkaline developing solution. Then, the film is baked at the temperature of 200°C to 250°C for 15 to 30 minutes, by which pattern formation of a pixel electrode 21 is implemented and an active matrix substrate is completed.

In thus-fabricated active matrix substrate, the pixel electrode 21 is composed of a photosensitive transparent conductive material, so that in the process of patterning the pixel electrode 21, the step of etching using photo resist is not necessary. Consequently, the pixel electrode 21 can be fabricated by a simple process consisting of applying a transparent conductive material with photosensitivity on the substrate, and performing mask-exposure and development. Therefore, the fabrication process of the pixel electrode can be shortened.

In addition, vacuum film-creating devices such as sputtering systems as well as etching units for ITO are not necessary, which enables reduction of equipment investments, decrease of device space required, and increase of working efficiency.

Further in the active matrix substrate of the present invention, the pixel electrode is formed on the interlayer insulating film which is formed on the gate signal line, source signal line, and the switching element, so that the pixel electrode is to be formed in the final fabrication process of the active matrix substrate. Consequently, the material of the pixel electrode could not affect the film-formation process of other parts, which brings about broader selections of materials for the pixel electrode. For example, such materials as coat-type

transparent conductive materials containing an organic component (resin component) as disclosed in the above-stated Japanese Patent Laid-Open Publication HEI 10-255556 can be broadly used.

For comparison, problems in the case where the coat-type transparent conductive material is adopted to an active matrix substrate with another structure as shown in Fig. 3 will hereinafter be described.

Fig. 3 is a cross sectional view of a conventional active matrix substrate which does not employ an interlayer insulating film 38 unlike the active matrix display shown in Fig. 1 and Fig. 2. In this case, after the pixel electrode 21 is formed, it is required to form an insulating overcoat 40 made from SiNx or SiO_2 for preventing exposure of the TFT 24 and the source signal line 23. The insulating overcoat 40 is normally formed by plasma CVD method at the temperature of 300°C or above. Consequently, if a coat-type transparent conductive material containing an organic component (resin component) according to the present invention is used as a material of the pixel electrode 21, it has been found that the pixel electrode 21 will degenerate in the formation process of the insulating overcoat 40 performed afterward.

Therefore, the configuration of the active matrix substrate in which the interlayer insulating film 38 is

provided underneath the pixel electrode 21 as shown in Fig. 1 and Fig. 2 is an optimal structure when using a coat-type transparent conductive material containing an organic component (resin component) as disclosed in the Japanese Patent Laid-Open Publication HEI 10-255556.

It will be understood that the photosensitive transparent conductive material is not limited to a material made from transparent photosensitive resin and ultrafine particles of ITO or ATO dispersed therein as described in the above-stated the Japanese Patent Laid-Open Publication HEI 10-255556. However, because this material is made from a photosensitive resin containing transparent conductive ultrafine particles, photosensitivity is easily imparted to the ITO material. Further, this material brings about an advantage that the photosensitive resin determining patterning conditions such as pre-bake temperature and light exposure, and the transparent conductive particles determining conductivity can be separately optimized. In addition, as the transparent conductive ultrafine particles for the photosensitive transparent conductive material, use of ITO or ATO makes it possible to facilitate implementation of the transparency (visible light transmissivity: 90% or above) and the electric characteristics (value of sheet resistance: 1E5Ω/□ or lower) required for the pixel electrode.

It will be also understood that the photosensitive transparent conductive material is not limited to a coat-type one, but a laminate-type dry film material is also applicable.

Next, the preferred fabrication process of the pixel electrode 21 to be used for the active matrix substrate of the present invention will be described with reference to Fig. 4.

Fig. 4 is a schematic view showing the fabrication process of the pixel electrode 21 used in the active matrix substrate described in the first embodiment.

First, Fig. 4-(1) shows a state in which, on the surface of an interlayer insulating film 38 formed on an active matrix substrate, there is applied a photosensitive transparent conductive material. In this case, a negative type photosensitive transparent conductive material (in which an exposed portion is left as a pattern) is used as the photosensitive transparent conductive material.

Fig. 4-(2) is a view showing the exposure process of the photosensitive transparent conductive material in the next step. As shown above, it is characterized in that the back side of the active matrix substrate is exposed to ultraviolet rays. Metallic signal lines (a gate signal line 22 and a source signal line 23) formed on the active matrix substrate function as exposure masks, so that the

ultraviolet rays are not emitted to the portions where the signal lines are placed. As to the portions of the photosensitive transparent conductive material to be exposed, which are hindered from being exposed to the rays from the back side (e.g., on top of the capacity line 27 or TFT 24), conventional exposure from the front side of the substrate may be performed together with the back side exposure.

Fig. 4-(3) shows a state in which the pixel electrode has been patterned by development processing in the next step. In the step shown in Fig. 4-(2), the back side exposure is performed by using the signal lines as masks, so that the pattern of a pixel electrode 21 is formed with the parts above the signal lines as boundaries.

As described above, the back side exposure with a negative type photosensitive transparent conductive material generates following advantages.

Performing exposure from the back side of the active matrix substrate by using the gate signal line and the source signal line formed on the substrate as exposure masks enables self-aligned pattern formation of a rectangle pixel electrode 21 without practicing alignment. As a result, dispersion of parasitic capacitance Cx, which is generated in a superposed portion X of the pixel electrode 21 and the source signal line 23 (or the gate signal line

22), can be uniformed in the entire pixel area. Consequently, if the active matrix substrate of the present invention is applied to flat panel display devices, the potential fluctuation of the pixel electrode 21 through the parasitic capacitance Cx is uniformed in all the pixels, which improves uniformity of display. In addition, if the active matrix substrate is applied to flat panel image sensing devices, the potential fluctuation of the pixel electrode 21 with the parasitic capacitance Cx is uniformed in all the pixels, which improves uniformity of photographed images.

In addition, since exposure is performed from the back side of the substrate, the photosensitive transparent conductive material applied over each signal line is not exposed unless any defect such as open holes is present on the signal lines. Accordingly, unlike the conventional case, there is not generated a conductive film remain in a clearance between pixel electrodes attributed to the presence of dust in the process of exposure. This ensures insulation between the pixel electrodes.

In the case where the active matrix substrate of the present invention is applied to liquid crystal display devices, orientation of liquid crystal molecules is disturbed in the vicinity of the edges of a pixel electrode 21. Accordingly, in order to cover up the disturbed

orientation, it is preferable to superimpose the edges of the pixel electrode 21 on the source signal line 23 (or the gate signal line 22). In that case, if the above fabrication process is used, setting exposure condition to an overexposure mode enables arbitral regulation of the width of the superimposed portion X of the pixel electrode 21 and the source signal line 23 (or the source signal line 22) within the range of 0 to 2μm.

Effect of the invention:

Since the active matrix substrate of the present invention has pixel electrodes made from a photosensitive transparent conductive material, in the process of patterning the pixel electrodes, the step of etching using photo resist is not required. That is, the pixel electrodes can be formed by the simple step of applying a photosensitive transparent conductive material over the substrate and performing mask exposure and development. Therefore, fabrication process of the pixel electrode can be shortened, and vacuum film-forming devices such as sputters as well as etching units for ITO are not required, which enables reduction of equipment investments, decrease of device space required, and increase of working efficiency. Further in the case of the active matrix substrate of the present invention, the pixel electrode is formed on the interlayer insulating film, which is formed

on the gate signal line, the source signal line and the switching element, so that the pixel electrode is to be formed in the final fabrication process of the active matrix substrate. Consequently, the material of the pixel electrode does not affect the film-formation process of other parts, which brings about broader selections of materials for the pixel electrode including a coat-type material containing an organic component (resin component).

In the active matrix substrate of the present invention, the photosensitive conductive material has negative type photosensitivity. Therefore, using the gate signal line and the source signal line formed on the substrate as exposure masks and performing exposure from the back side of the substrate enable self-aligned pattern formation of film without practicing alignment. As a result, dispersion of parasitic capacitance, which is generated in a superposed portion of the pixel electrode and the gate signal line or in a superposed portion of the pixel electrode and the source signal line, can be uniformed in the entire pixel area, by which the uniformity of display is improved. In addition, a photosensitive transparent conductive material applied over each signal line is not exposed unless any defect such as open holes is present on the signal lines. Accordingly, unlike the conventional case, a conductive film remain is not

generated in clearance between pixel electrodes by the presence of dust in the process of exposure, which ensures insulation between the pixel electrodes.

Brief explanation of the drawings:

Fig. 1 is a plan view showing an active matrix substrate according to an embodiment of the present invention;

Fig. 2 is a cross sectional view taken on the line A-A' of Fig. 1;

Fig. 3 is a cross sectional view showing an active matrix substrate serving as a comparative example of the present invention.

Fig. 4 is a schematic view showing a fabrication process of the active matrix substrate of the embodiment of the present invention;

Fig. 5 is a plan view showing a conventional active matrix substrate; and

Fig. 6 is a cross sectional view taken on the line B-B' of Fig. 5.

Explanation of numerals:

31 light permeable substrate

22 gate signal line

23 source signal line

27 capacity line

21 pixel electrode

33 gate insulating film

34 semiconductor layer

35 channel protection layer

36a source electrode

36b drain electrode

37b metal line

37a transparent conductive line

25 connection electrode

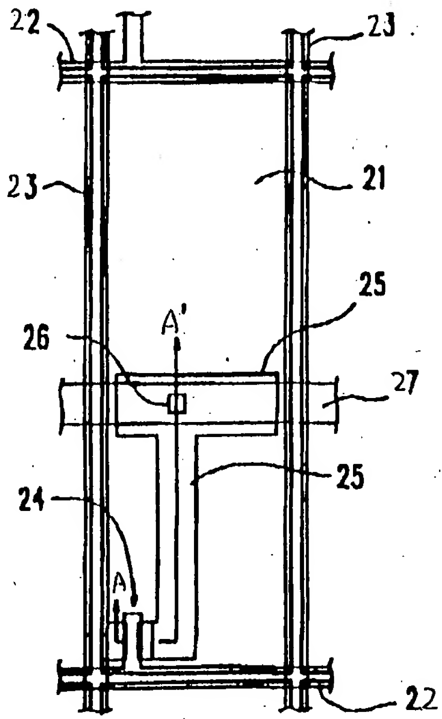
38 interlayer insulating film

26 contact hole

24 TFT (thin film transistor)

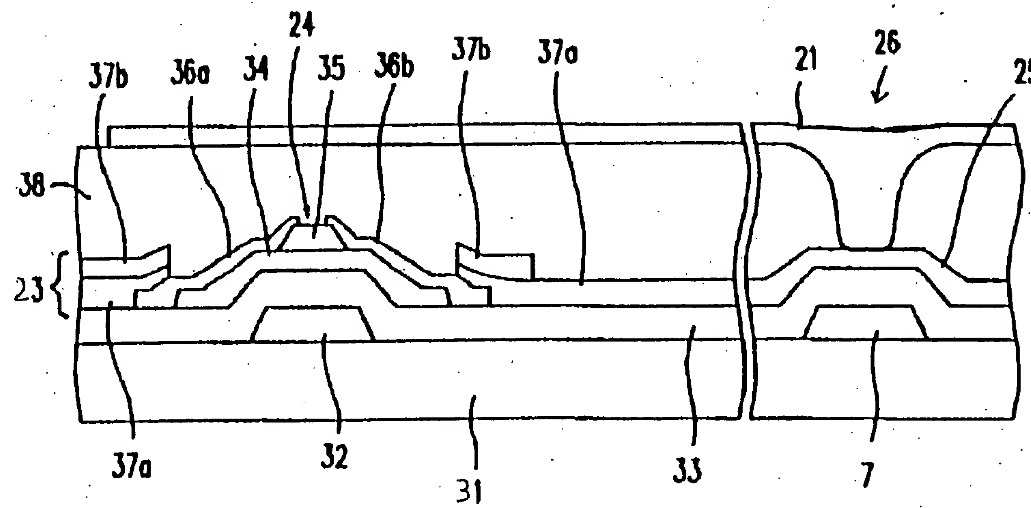
x 2.0

Fig. 1



x 1.4

Fig. 2



x1.4

Fig. 3

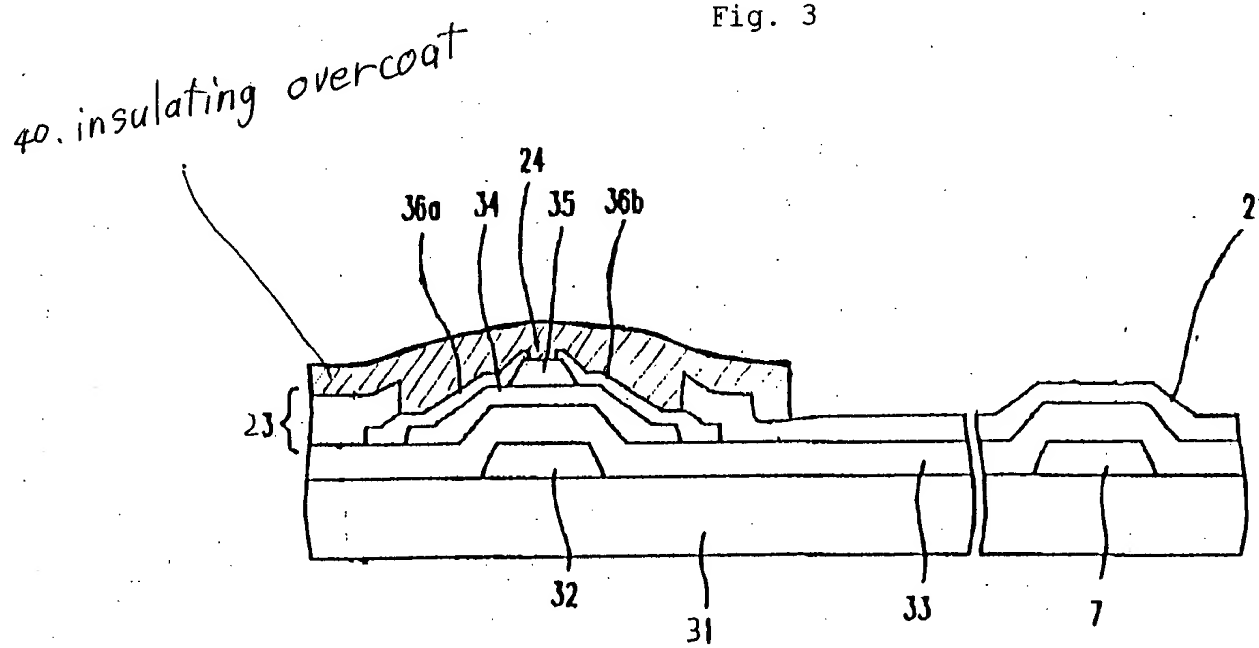
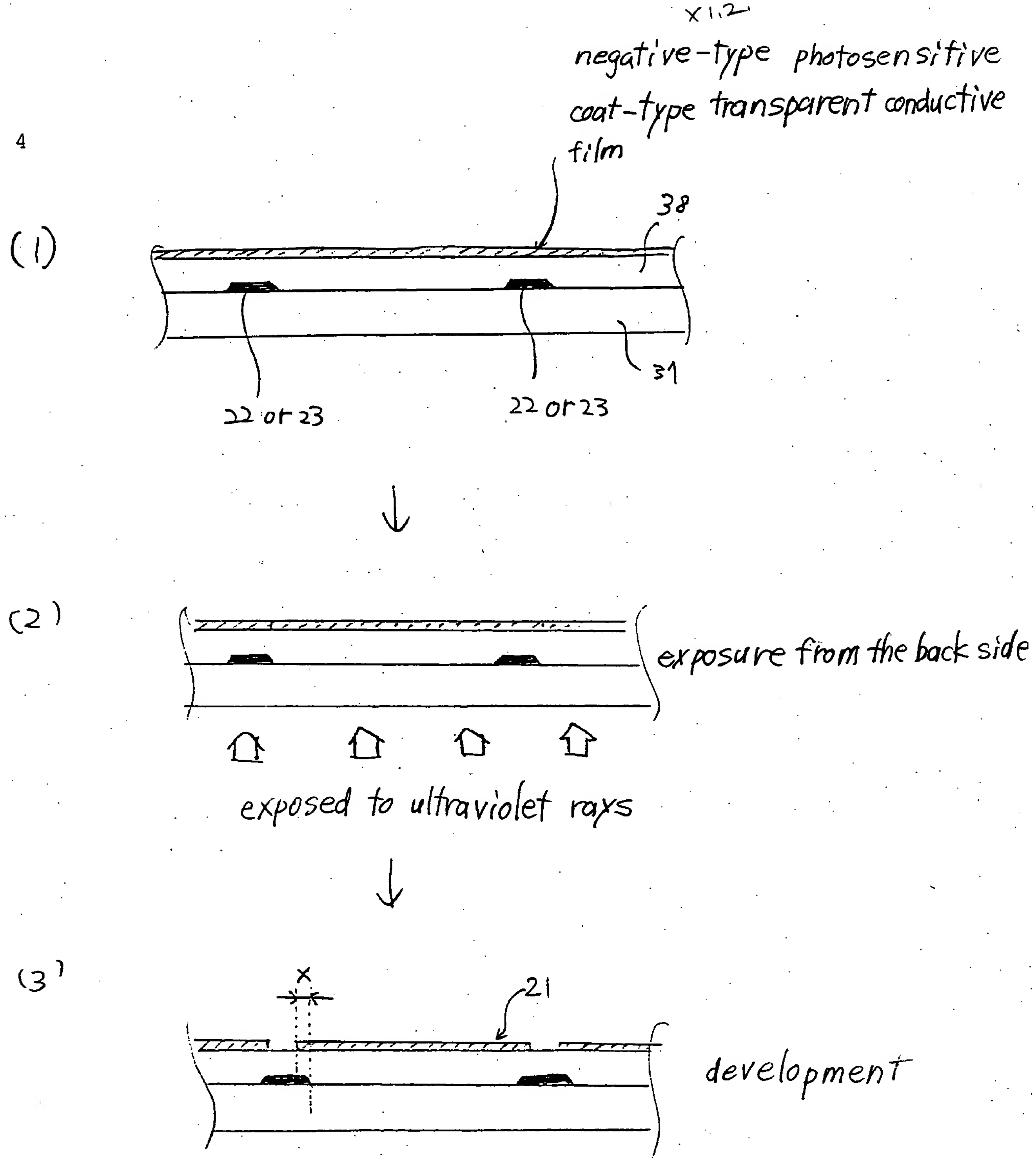
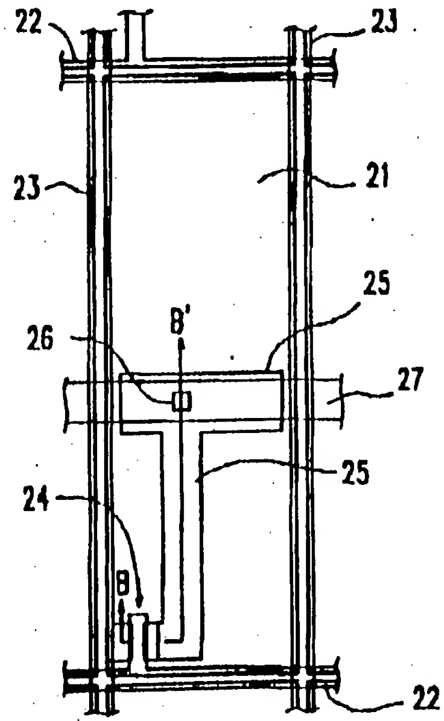


Fig. 4



×1.2
negative-type photosensitive coat-type transparent conductive film
(1)
38
31
22 or 23
22 or 23
(2)
exposure from the back side
exposed to ultraviolet rays
(3)
x
21
development

Fig. 5


22
23
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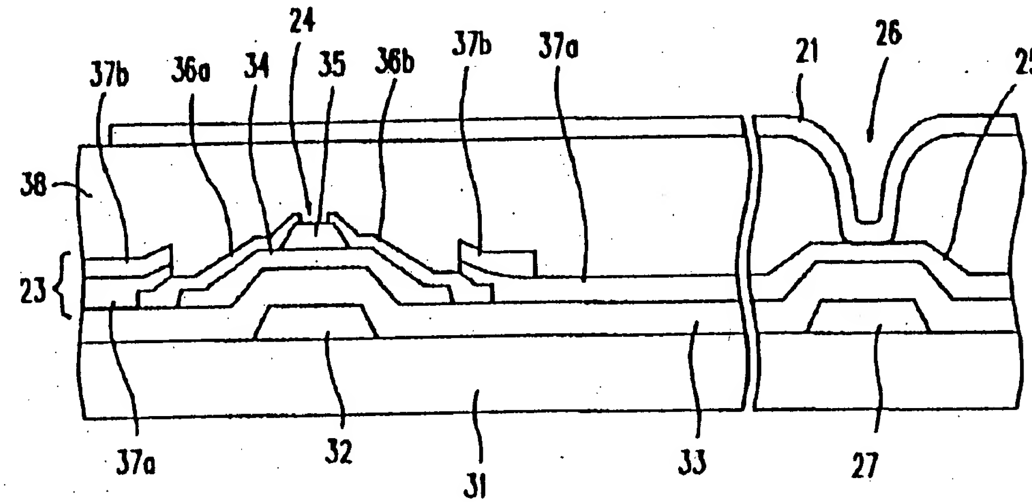
26
B'
27
25
24
B
22

Fig. 6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